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Microfilm Products Division

March 3, 1967

Mr. T. Nelson
Systems Consultant
Box 1546
Poughkeepsie, N. Y. 12603

Dear Mr. Nelson:

Enclosed is the information manual for the new magnetic tape-to-microfilm printer which has been developed by the 3M Company. The principle of direct electron beam recording offers recording speeds and resolution which are not subject to the limitations imposed by cathode ray tubes, cameras, and conventional wet film processing. The EBR system provides printing speeds up to 30,000 lines per minute on a new instantly processed dry silver microfilm. This printing capability encompasses upper case, lower case, bold face type, size variations, and the automatic merging of background graphics such as pre-printed forms. The output film can then be used for the creation of duplicate films, offset masters and hard copy.

Our program in CRT display print technology has lead to the development of a light exposed heat developed paper which provides a black and white print of a CRT image in a few seconds. The mechanism which provides this print out is being offered on an OEM basis to computer and display equipment manufacturers. Please contact your EDP or display supplier for its availability in your area.

Thank you very much for your interest in the computer graphic programs of the 3M Company. Please let us know if you require additional information.

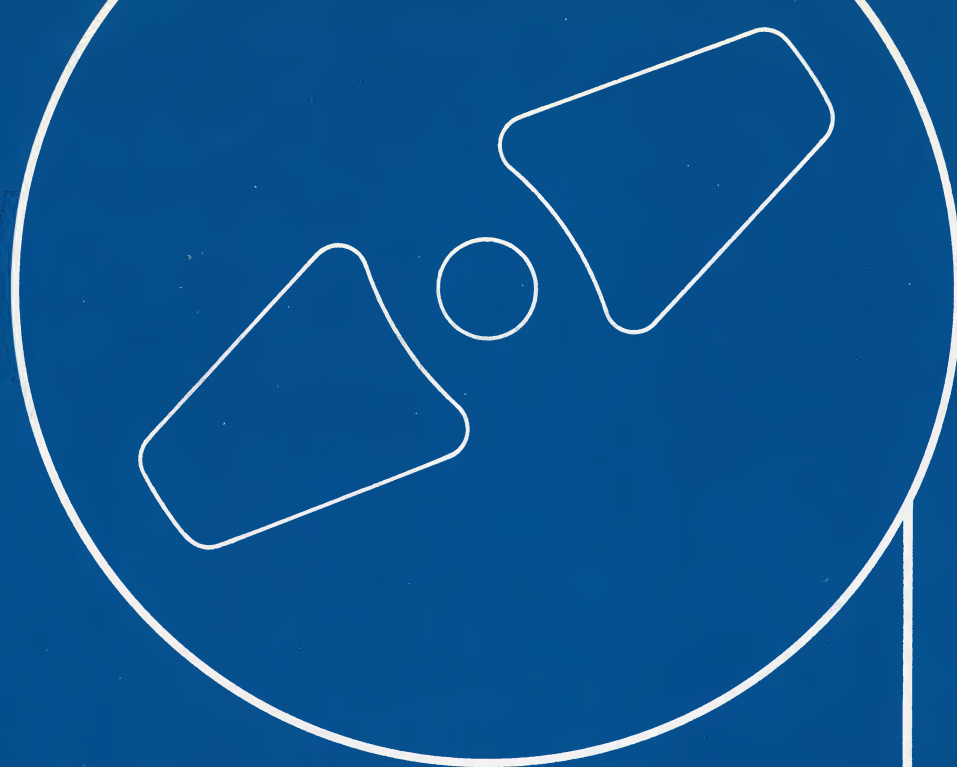
Very truly yours,

A handwritten signature in dark ink, appearing to read 'Rolf E. Westgard', written in a cursive style.

Rolf E. Westgard
Computer Graphics

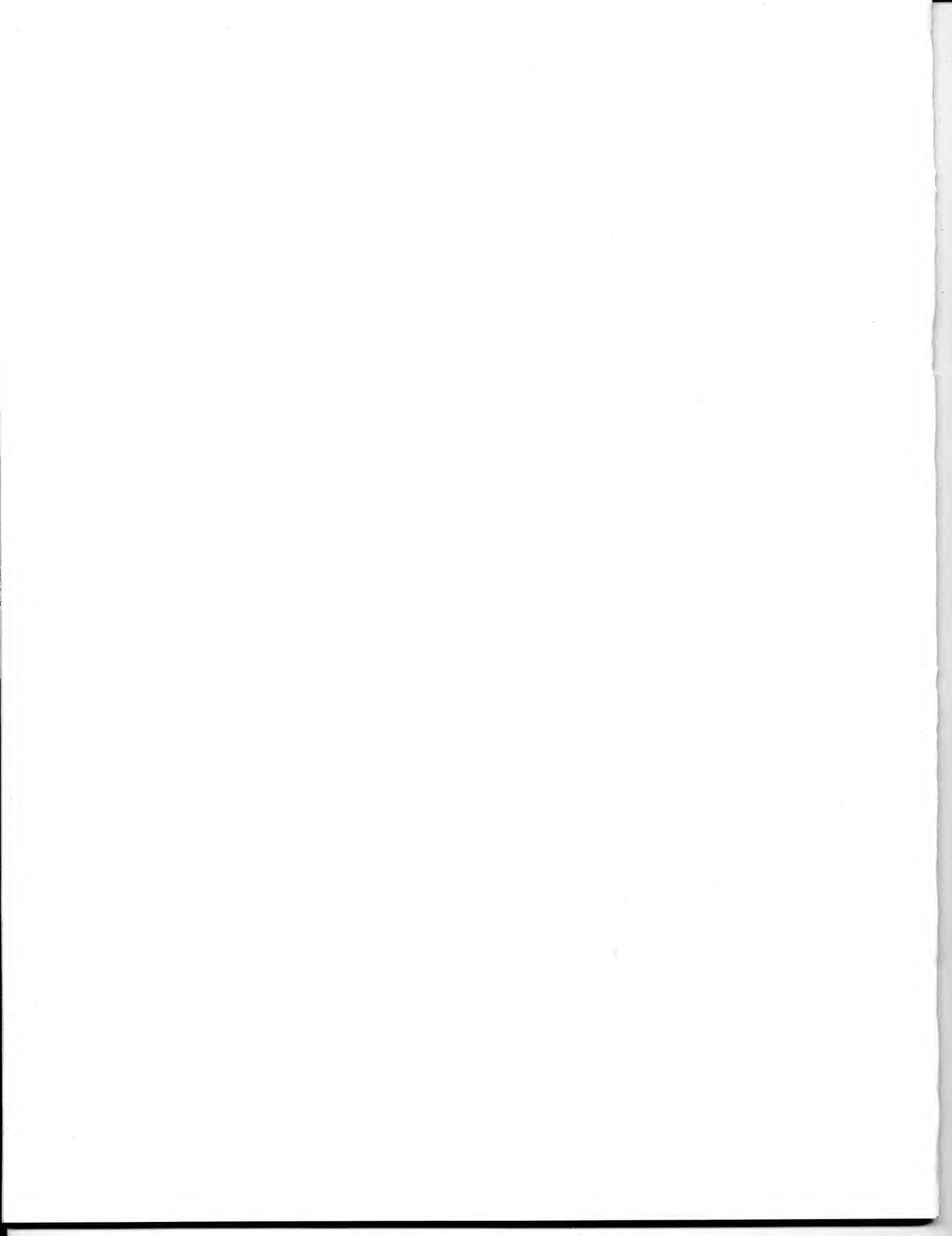
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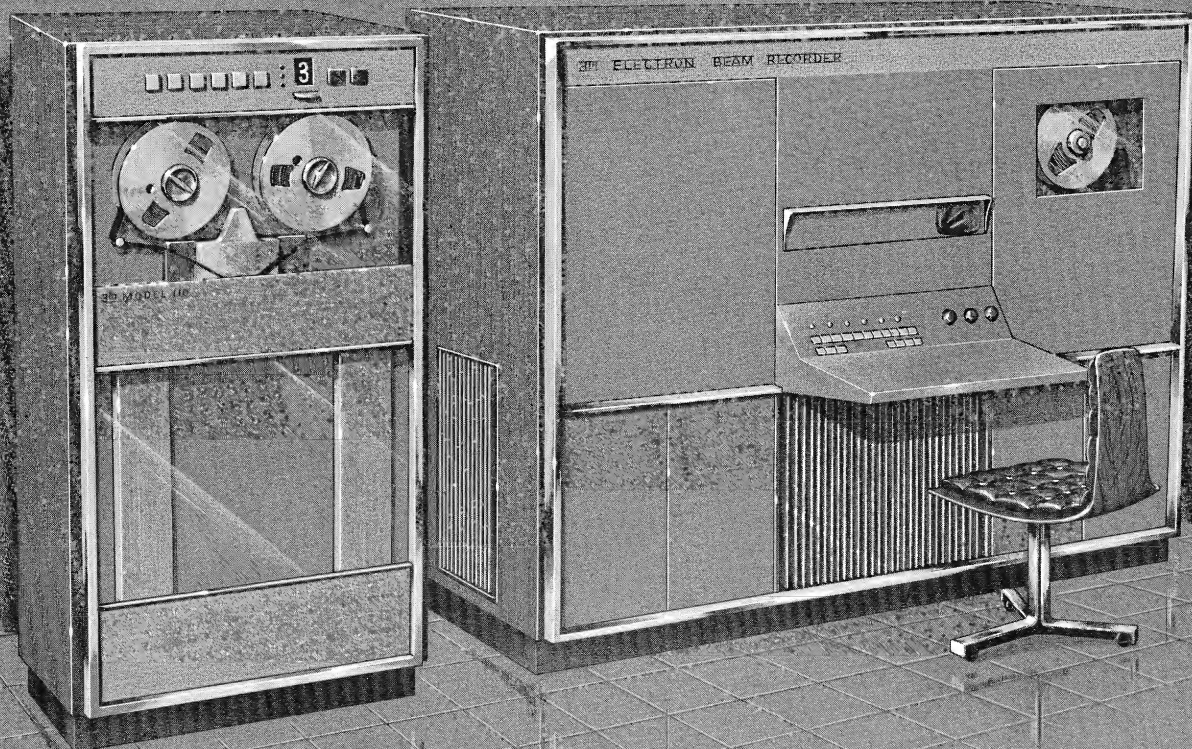
INFORMATION MANUAL

SERIES F
ELECTRON BEAM
RECORDER SYSTEM



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INTRODUCTION

The 3M company offers the computer user an answer to the need for converting computer-generated digital information stored on magnetic tape into printout at speeds compatible with tape units -- up to 20,000 lines per minute. 3M's answer is in the form of two new products: the Series F Electron Beam Recorder (EBR), and its output media, Dry-Silver Microfilm.

3M EBR computer-microfilm systems are specially designed for EDP information management applications. Conventional microfilm excels as an output media for these applications except that it must be developed before the images can be viewed. In 3M EBR systems using Dry-Silver Microfilm, however, the film processing time places no constraints on the speed of the total system. In one operation, the EBR converts the digital language on your computer-generated tape into easy-to-use microfilm images. Film processing is done within the EBR which keeps pace with the magnetic tape unit supplying the digital information -- no buffers are required.

The advantages of microfilm apply to computer output just as they do any other type of graphic information. Because microfilm occupies less than 1/20th of the space required by conventional output papers, it is easier to handle, mail, file and retrieve. Cost savings are attractive, too. Data can be read using a portable viewer, and hard copy is available in seconds with the press of a button on a microfilm printer.

To learn more about the EBR system, take about 25 minutes and read this manual. You will be introduced to the EBR system requirements, operating procedures and theory of operation.

THE EBR SYSTEM

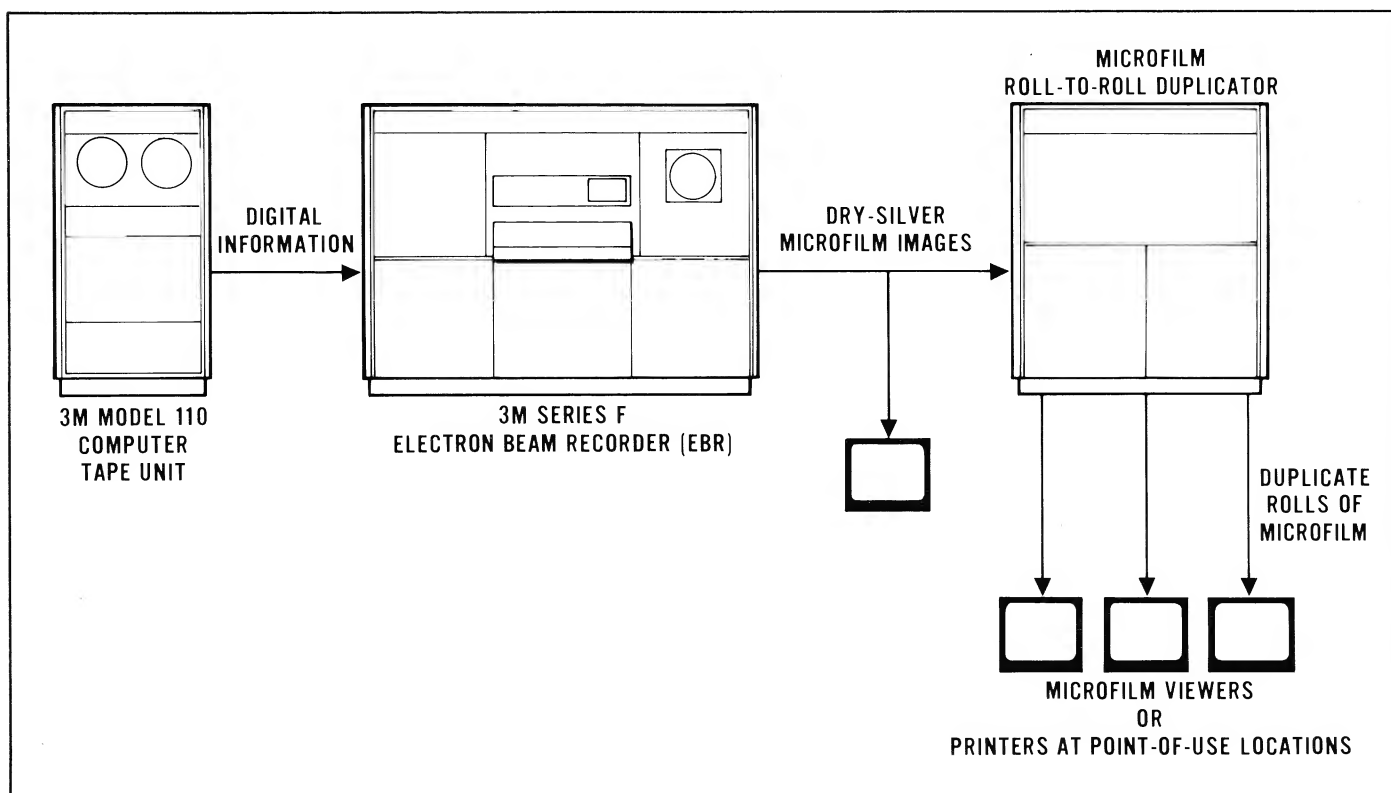


Figure 1. A Typical EBR System

A typical 3M EBR microfilm printout system (Figure 1) consists of a 3M Model 110 computer tape unit, Series F electronbeam recorder, a roll-to-roll microfilm duplicator, and microfilm viewers or printers at point-of-use locations. The system is operated off line with respect to the main computer.

The Model 110 computer tape unit handles 7 track (9 track format compatible with IBM Series 360 systems is optional), one-half inch magnetic tape. Computer generated data are stored in standard binary coded decimal (BCD) format (Table 1). Storage densities are 556 and 800 characters per inch. Tape speed is 75 inches per second.

The Series F EBR, complete with options, is a self-contained unit which includes control interfacing electronics, a film transport system, an electron beam gun, an optical forms insertion system, a film developing unit, and a viewer for inspecting images.

Digital information is transferred from the tape unit to the Series F EBR at rates of 60,000 or 41,700 characters per second, depending upon the storage density.

Character Set	Octal Code	BCD Code Channels BA8421	Character Set	Octal Code	BCD Code Channels BA8421
Space	20	A	N	45	B 4 1
1	1	1	O	46	B 42
2	2	2	P	47	B 421
3	3	21	Q	50	B 8
4	4	4	R	51	B 8 1
5	5	4 1	!	52	B 8 2
6	6	42	\$	53	B 8 21
7	7	421	*	54	B 84
8	10	8	]	55	B 84 1
9	11	8 1	;	56	B 842
Ø	12	8 2	△	57	B 8421
#	13	8 21	&	60	BA
+@	14*	84	A	61	BA 1
:	15	84 1	B	62	BA 2
>	16	842	C	63	BA 21
/	21	A 1	D	64	BA 4
S	22	A 2	E	65	BA 4 1
T	23	A 21	F	66	BA 42
U	24	A 4	G	67	BA 421
V	25	A 4 1	H	70	BA8
W	26	A 42	I	71	BA8 1
X	27	A 421	?	72	BA8 2
Y	30	A8	.	73	BA8 21
Z	31	A8 1	□	74	BA84
,	33	A8 21	[	75	BA84 1
%	34	A84	<	76	BA842
-	40	B	⌘	77	BA8421
J	41	B 1	✓	35	A84 1
K	42	B 2	✓	17	8421
L	43	B 21	↖	36	A842
M	44	B 4	++	37	A8421
			‡	32	A8 2

* + is a control code; @ is a printable character

Table 1. Standard Characters and BCD/Octal Codes.

Control interfacing in the EBR responds to the digital codes by activating the appropriate electronic character generating circuits and converting the printable data from digital format to analog signals suitable for electron beam character generation on the microfilm. It also processes control code information, such as image format, and forms insertion commands.

The electron beam inside the electron gun is modulated by the analog signal output of the control interfacing section. Using the stroke method, the beam "writes" standard size or enlarged symbols on 16mm Dry-Silver Microfilm, forming a latent image (Figure 2).

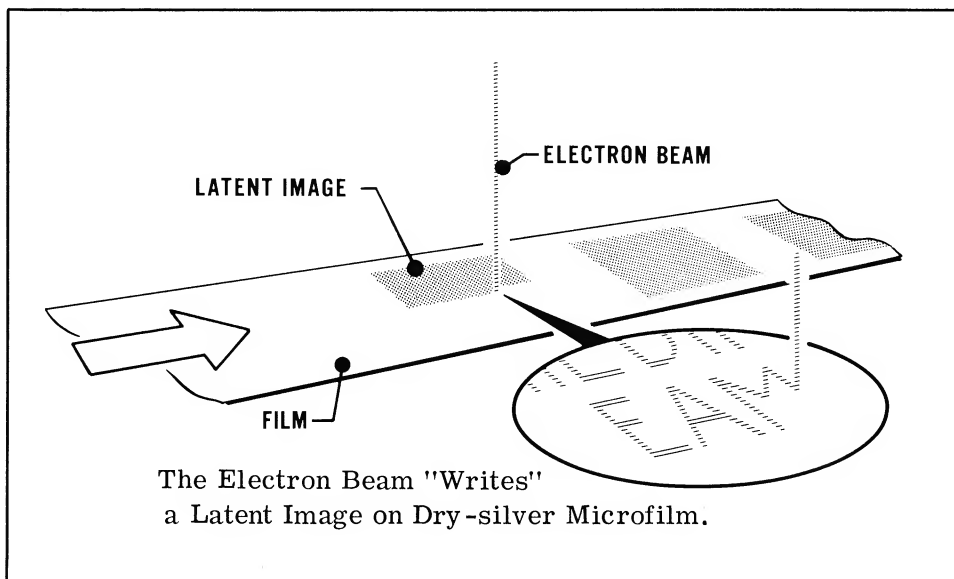


Figure 2. Latent Image Formation on Dry-Silver Microfilm Using an Electron Beam.

Image format (tabulation and vertical positioning of lines) can be programmed onto the tape, or the system can operate using some existing tapes programmed for conventional printers -- image format then corresponds to that of the printer program.

After the frame has been "exposed" by the electron beam, the tape transport, responding to a control code, advances a new frame under the electron gun.

The microfilm frame containing the latent image then advances to the optical forms insertion device. Forms can be inserted singularly, randomly or sequentially.

The film frame, now containing latent images of characters and form lines, moves on to the developing station. Heat is applied to the film and the images develop . . . no solutions are used.

Prior to being wound on the take-up reel, the film passes an inspection viewer.

The output of the EBR is positive-appearing frames of microfilm, 14 mm square, in roll form. Output rate is eight frames per second. The film is ready for viewing, copying or duplicating.

If the system requirements are for more than one roll of microfilm, the output of the EBR can be duplicated on a conventional roll-to-roll microfilm duplicator. Most applications require the duplicate rolls to be negative appearing film -- typical of that obtained from conventional microfilm camera and processor systems.

Output of the roll-to-roll microfilm duplicator can then be sent to point-of-use locations where it is viewed with microfilm viewers or hard copies are made using microfilm printers.

MAGNETIC TAPE FORMATS

Magnetic tape used as input to the EBR can be written in one of two formats: (1) programmed tabulation and skip (PTS), designed to conserve magnetic tape, and (2) IBM 1401/1403 compatibility, referred to in this manual as simply the "compatibility" format.

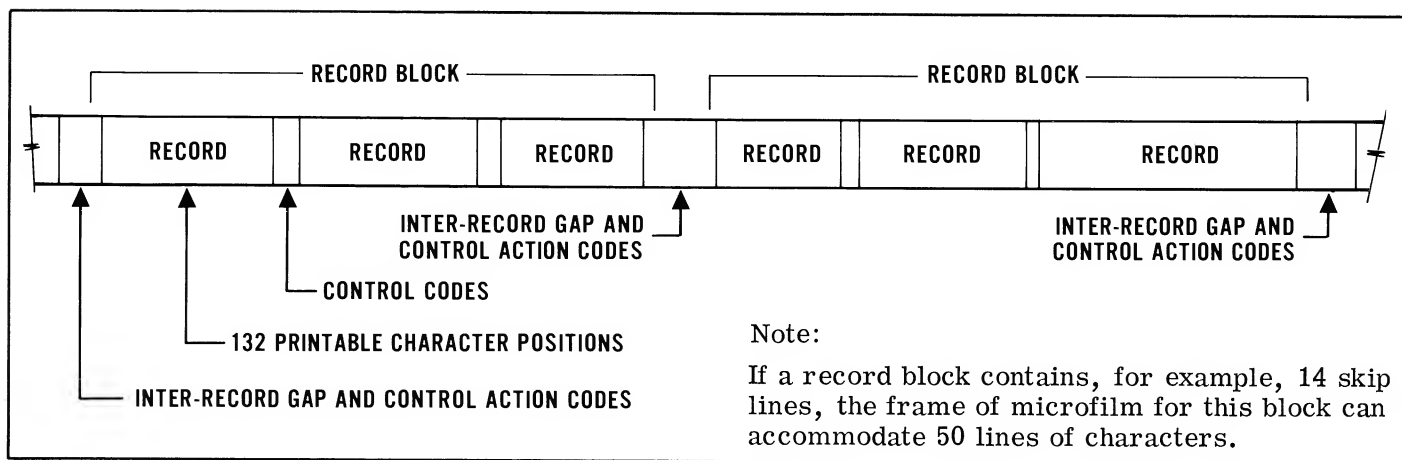


Figure 3. Relationship of Records and Record Blocks on Magnetic Tape Programmed for EBR Applications.

In either format, tape records must not contain digital codes for more than 132 standard size printable characters, and record blocks must contain records for no more than 64 lines, including skip lines. Figure 3 illustrates a typical tape. Note that each record (series of printable characters) is preceded by one or more control codes and inter-record gaps. One or more records on the magnetic tape can be the equivalent of one line of characters on the microfilm output media. The information contained on one record block is transferred to one frame of microfilm.

PROGRAMMED TABULATION AND SKIP FORMAT (PTS)

When in the PTS mode of operation, the EBR interface control logic recognizes six classes of control codes: (1) character, (2) tabulation, (3) vertical skip, (4) action, (5) record mark, and (6) record gap. Each class consists of several code symbols except for the conventional record mark ($\pm$) and record gap (3/4 inch of blank tape). Figure 4 illustrates one complete record block containing three individual records; symbols from each code class are included as examples in the illustration.

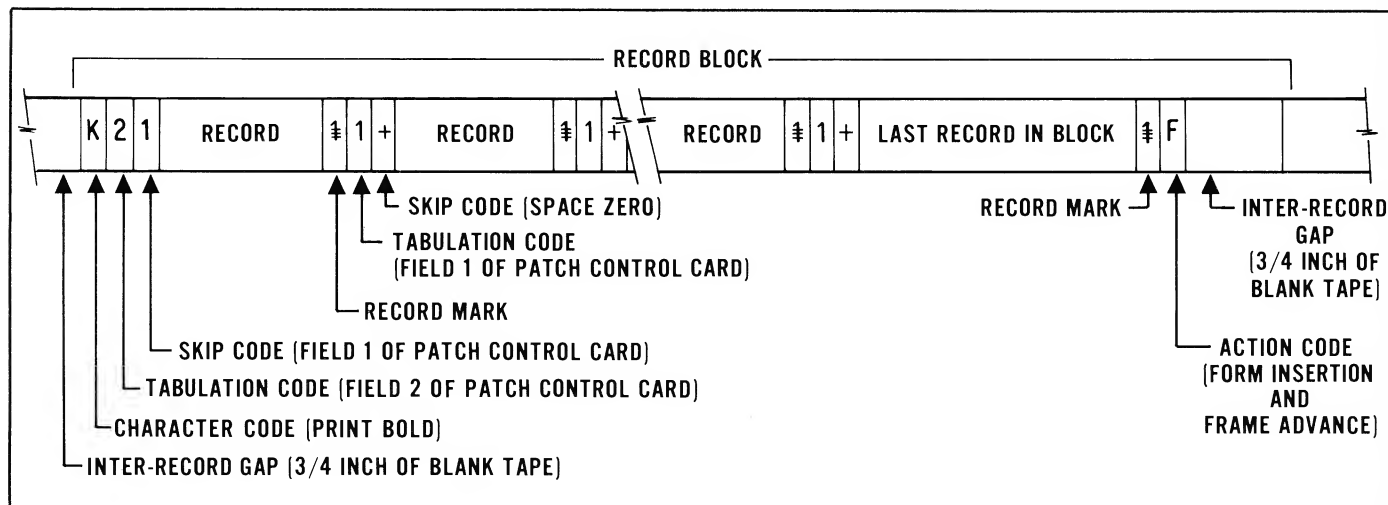


Figure 4. Complete Record Block with Examples of Control Codes

Code Symbol	Command
space (octal 20)	Vertical line space 1
Ø (octal 12)	Vertical line space 2
- (octal 40)	Vertical line space 3
1 (octal 1)	Skip page
+	Suppress skip

The following code symbols command EBR logic to obtain instructions from skip fields of patch control card.

1 (octal 1)	1 Field
2 (octal 2)	2 Field
3 (octal 3)	3 Field
4 (octal 4)	4 Field
5 (octal 5)	5 Field
6 (octal 6)	6 Field
7 (octal 7)	7 Field
8 (octal 10)	8 Field
9 (octal 11)	9 Field

Table 2. Vertical Skip Codes and Commands with EBR in "Compatibility Mode" of Operation.

COMPATIBILITY FORMAT

When the EBR is in the compatibility mode of operation, it will accept as input tapes which are compatible with the IBM 1401/1403 print-out system. In this mode the EBR recognizes the control code symbols listed in Table 2; code symbols other than these are interpreted as spaces.

Table 2 lists the control code "1" twice. The EBR logic interprets this code symbol as two commands: (1) skip page (advance microfilm frame), and (2) respond to skip control code contained in field one of patch control card (a complete description of the patch control card is given on page 12 of this manual).

The compatibility mode is enabled by a specially prepared patch control card inserted in the EBR.

A comparison of tapes programmed in the compatibility and PTS formats is given in Figure 5.

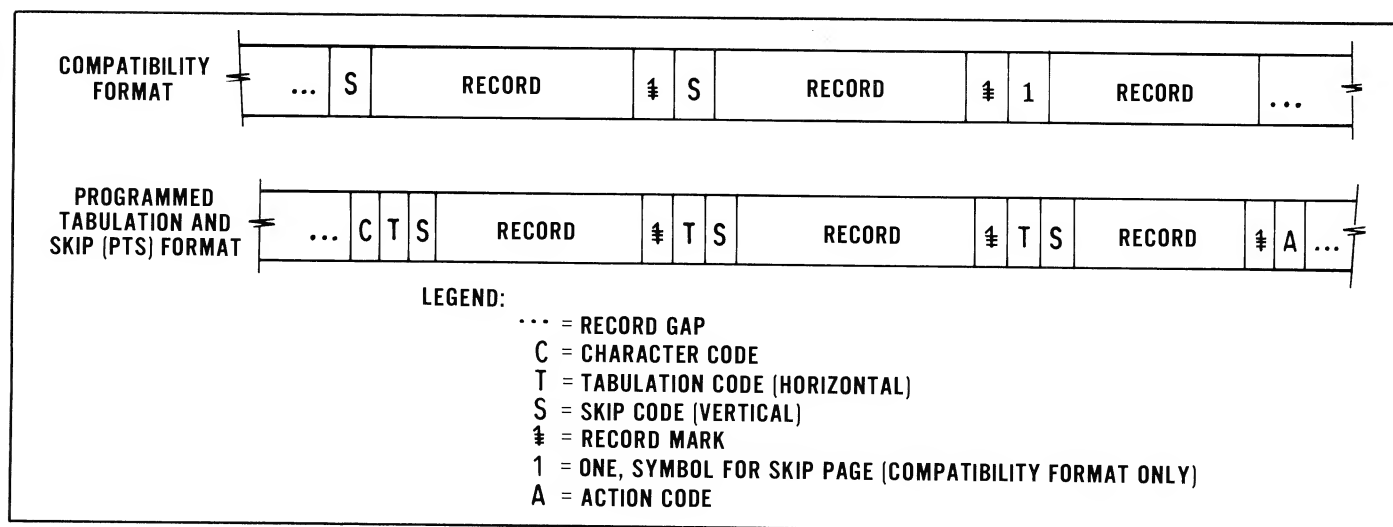


Figure 5. Comparison of Record Blocks Programmed in PTS and "Compatibility".

CONTROL CODES -- PTS MODE

The following paragraphs describe the classes of control codes used when the EBR is in the PTS mode of operation.

CHARACTER CONTROL CODES

A Character Control Code symbol, if present, is the first of a control code group preceding the printable data of a record. A character

<u>Code Symbol</u>	<u>Command</u>
J (octal 41)	Print large
K (octal 42)	Print bold
△ (octal 57)	Shift to optional set of characters (can be used for printing upper case)

Table 3. Code Symbols for Character Control Commands.

control code on the tape instructs the EBR to print normal-size bold, or oversize (two times as large) characters, or, if the additional 64-character option is included, to print in lower case. The absence of a character code symbol instructs the machine to print standard size characters. If no character code is present, the EBR interprets the first control code as a tabulation code; if a character code is present, the EBR interprets the second control code as the tabulation code. Character control symbols are given in Table 3.

<u>Code Symbol</u>	<u>Command</u>
	Obtain instructions from following tab fields of patch control card:
1 (octal 1)	1 Field
2 (octal 2)	2 Field
3 (octal 3)	3 Field
4 (octal 4)	4 Field
5 (octal 5)	5 Field
6 (octal 6)	6 Field
7 (octal 7)	7 Field
8 (octal 10)	8 Field
9 (octal 11)	9 Field

Table 4. Tabulation Codes and Respective Commands.

TABULATION CODE

The tabulation code immediately follows the character code. If no character code is present, the horizontal tabcode is the first in the con-

Code Symbol	Command
+ (octal 14)	Vertical line space 0
space (octal 20)	Vertical line space 1
Ø (octal 12)	Vertical line space 2
- (octal 40)	Vertical line space 3
The following code symbols command EBR logic to obtain instructions from tab fields of patch control card.	
1 (octal 1)	1 Field
2 (octal 2)	2 Field
3 (octal 3)	3 Field
4 (octal 4)	4 Field
5 (octal 5)	5 Field
6 (octal 6)	6 Field
7 (octal 7)	7 Field
8 (octal 10)	8 Field
9 (octal 11)	9 Field

Table 5. Skip Codes and Respective Commands with EBR in PTS Mode of Operation

trol code group preceding the printable data of the record. The tab code signals the EBR to respond to instructions defined by a second code contained in one of nine fields of a patch control card (tabulating card). Programming of the patch control card is described on page 12 of this manual.

Table 4 defines the nine symbols used in the tabulation control code class, and the appropriate response.

VERTICAL SKIP CODE

The vertical skip code immediately follows the tab code, and immediately precedes the first printable character of a record. Thirteen code symbols (Table 5) compose the vertical skip class. The first four of these symbols, stored in the EBR logic, are interpreted as specific skip instructions. The remaining nine symbols direct the EBR to respond to the instructions logically stored in the patch control card in the same manner as is done for tabulation.

ACTION CODES

An action code, if present, is the first symbol following a record mark at the end of a record block. It must always be followed by a record mark and/or an inter-record gap. Table 6 lists the three action code symbols and the command each represents.

Code Symbol	Command
A (octal 61)	Execute frame advance
F (octal 66)	Execute form insertion and frame advance
✓ (octal 35)	End of file (indicator light glows)

Table 6. Action Code Symbols and Respective Commands.

RECORD MARK AND INTER-RECORD GAP

The symbol for the record mark is the standard "⌘." A record mark follows each record and instructs the electron beam to interpret the following character as a command code.

An inter-record gap is a 3/4-inch segment of blank tape. When the tape head of the tape unit senses an action code followed by an inter-record gap, the tape drive stops; the gap allows the EBR to advance one frame of microfilm before restarting the tape unit.

PATCH CONTROL CARD FORMAT

The patch control card is a tabulating card which is inserted into a card reader section of the EBR. Coding and theory of operation is much the same as for any standard tabulating card system.

The card is divided into 18 fields -- nine tab fields and nine skip fields. Tab fields include three columns, and skip fields include two columns. A three-column tab field can contain punched codes representing tab locations of from one to 132 character positions. And the two-column skip fields can contain codes representing line locations one to 64 (these are practical limits dictated by the microfilm image format; limits of the card fields exceed these numbers).

Figure 6 illustrates a typical patch control card. Note that tab and skip fields having the same symbol (number) code are adjacent. Thus, the tab and skip fields alternate across the card.

An example of a simple program is as follows: A tab code of 6 on the tape instructs the EBR to respond to tabulatory action defined in field 6 on the card. Field 6, in the illustration, contains punch codes for

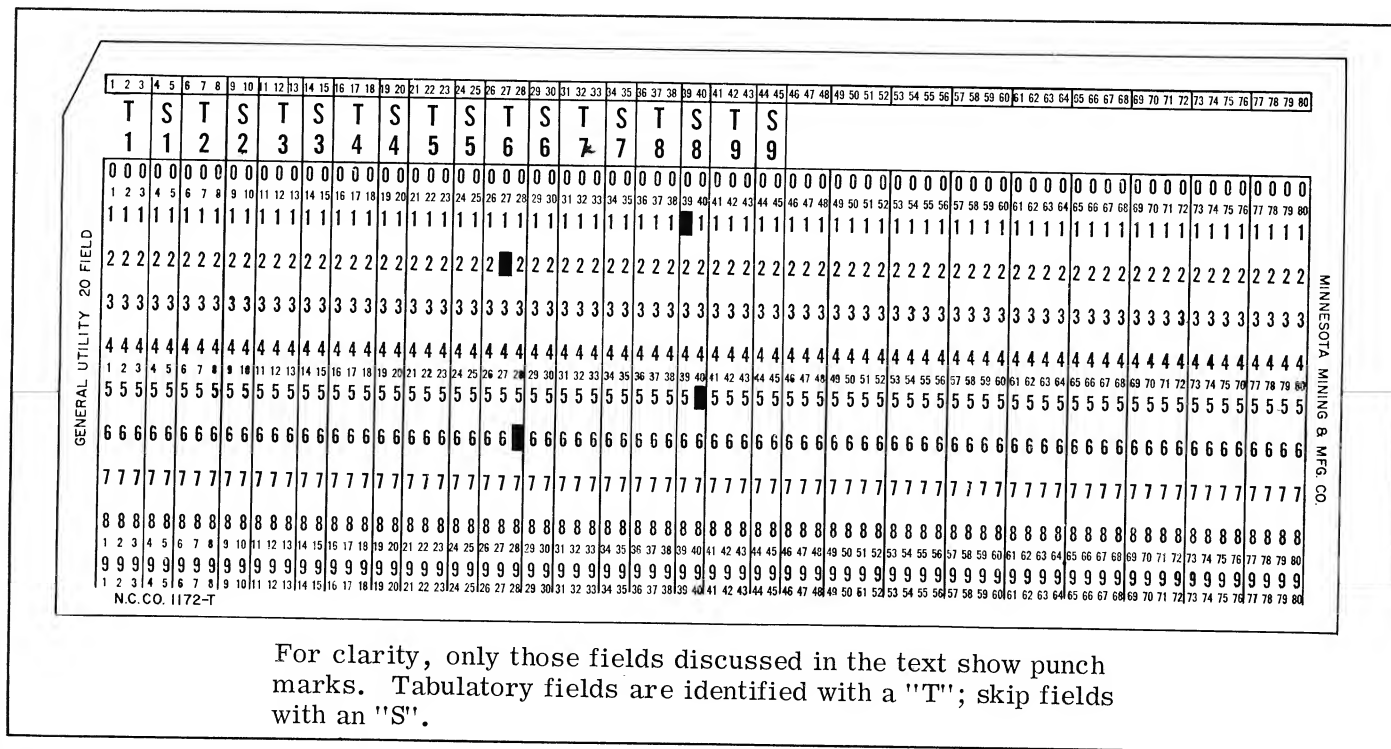


Figure 6. Typical Patch Control Card

the number 26. The skip code on the tape instructs the EBR to respond to skip action defined in field 8 on the patch control card. Field 8 contains the number 15. The electron beam, then, tabulates to character position 26, skips to line 15 on the microfilm frame, and writes the first character at this position.

A special patch control card is inserted in the EBR when the unit is operated in the compatibility mode. This card contains instructions in a field not normally used for skip instructions which indicate to the EBR circuitry that the "compatibility mode" is active.

IMAGE FONT AND FORMAT

Image font and format on the 16mm microfilm output media of the 3M Series F Electron Beam Recorder is defined below:

CHARACTER FONT

The Control Interfacing portion of the EBR contains character generating circuits for 64 symbols (Table 1). Electronic circuitry for an additional 64 symbols is optional, increasing character generating capability. If the option is included, upper and lower case symbols are provided (Figure 7).

	0	1	2	3	4	5	6	7
0	0	1	2	3	4	5	6	7
1	8	9	:	=	≠	≤	≥	[
2	+	A	B	C	D	E	F	G
3	H	I	<	.	)	≥	¬	;
4	-	J	K	L	M	N	O	P
5	Q	R	V	\$	*	↑	COMMAND	>
6	BLANK	/	S	T	U	V	W	X
7	Y	Z	J	,	(	→	≡	Λ

UPPER CASE (STANDARD)

	0	1	2	3	4	5	6	7
0	∇	ι	z	3	ψ	ρ	γ	φ
1	ω	α	β	δ	Σ	σ	μ	π
2	θ	a	b	c	d	e	f	g
3	h	i	2	3	"	'	∞	?
4	±	j	k	l	m	n	o	p
5	q	r	/	δ	.	Δ	COMMAND	Γ
6	BLANK	←	s	t	u	v	w	x
7	y	z	~	□	0	Δ	◇	∇

LOWER CASE (OPTIONAL)

Figure 7. Character Font

In addition to the normal printing mode, the electron beam will print symbols enlarged two times or print them in a bold format. Enlarged and bold printing is executed upon command of special print control codes.

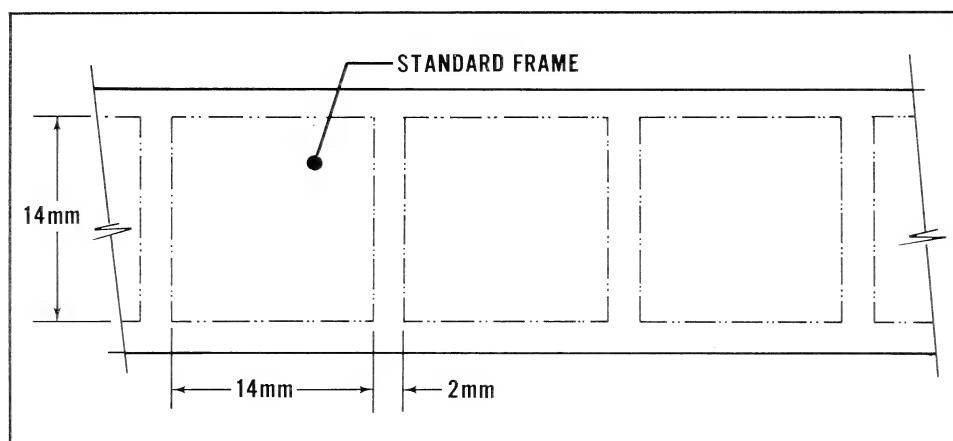


Figure 8. Frame Size

IMAGE SIZE AND CHARACTER PLACEMENT

The microfilm image is contained within the boundaries of a frame (Figure 8) measuring 14mm square. When the unit is operated in the standard-size-character or bold-character modes, the frame contains 64 lines, each line having 132 character positions. Microfilm generated when the EBR is in the enlarged-character mode (characters are enlarged two times) contains 32 lines, each line having 66 character positions.

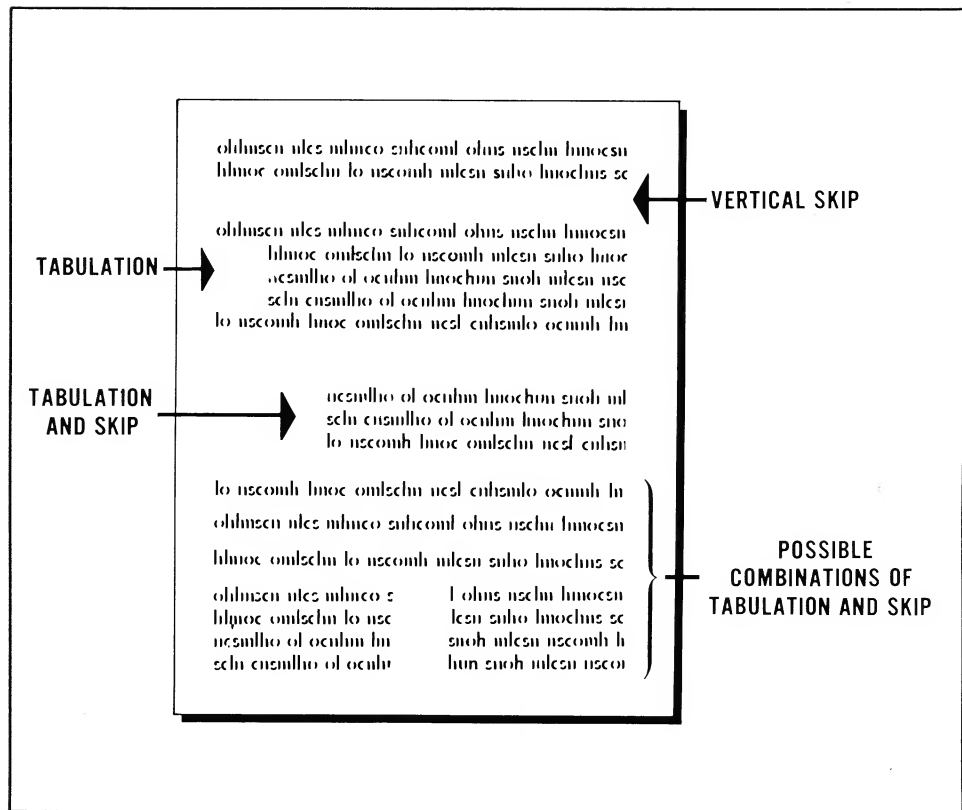


Figure 9. Examples of Tabulation and Vertical Skip of Lines and Characters on EBR-Generated Microfilm.

LINE SPACING AND TABULATION

In addition to standard skips of zero, 1, 2 and 3 lines, the EBR logic allows the selection of nine vertical skip positions (Figure 9). That is, vertical spacing of 4, 5, 6 lines . . . or any increment may be programmed into the system.

When in the PTS mode of operation, the EBR also has provision for up to nine tabulation locations. This feature allows tabulation of from one to 132 character positions upon command of a single code symbol. There is no need to use tape space for inserting a series of spaces to achieve tabulation.

IMAGE RESOLUTION

Image resolution -- the ability of the microfilm image to define detail -- is consistent with good microfilm practice.

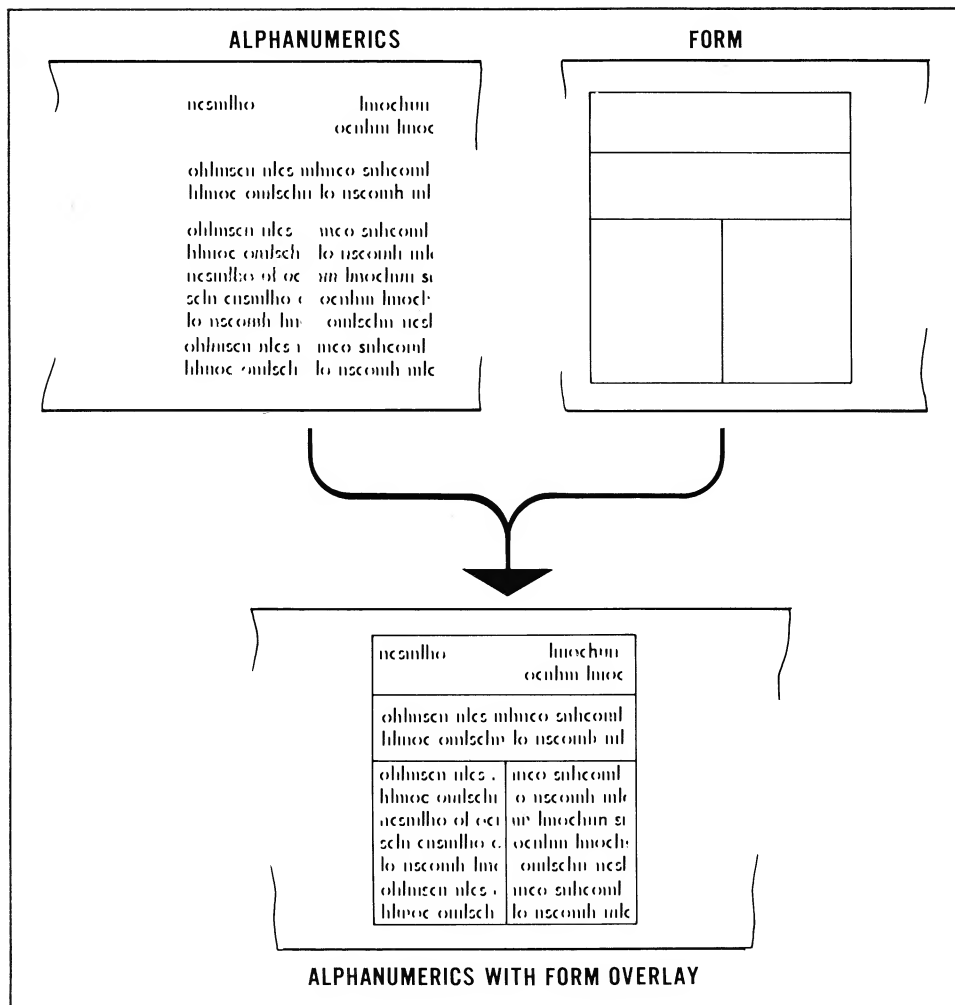


Figure 10. Merging of Alphanumerics and Form.

FORMS INSERTION

The forms insertion feature of the EBR permits printing of catalogs, maintenance manuals, and similar publications which include a combination of alphanumeric and graphic (form) information (Figure 10). Three optional capabilities are available:

Single form -- An image contained on a frame of 16mm microfilm may be recorded as an overlay or interspersed with alphanumerics.

Random forms retrieval -- Random access storage for 32 images may be selectively accessed for forms insertion under control of the program.

Sequential Forms Insertion -- Up to 2,000 images may be stored on roll microfilm and sequentially retrieved for insertion or overlay onto the alphanumeric data on program control.

TECHNICAL DESCRIPTION

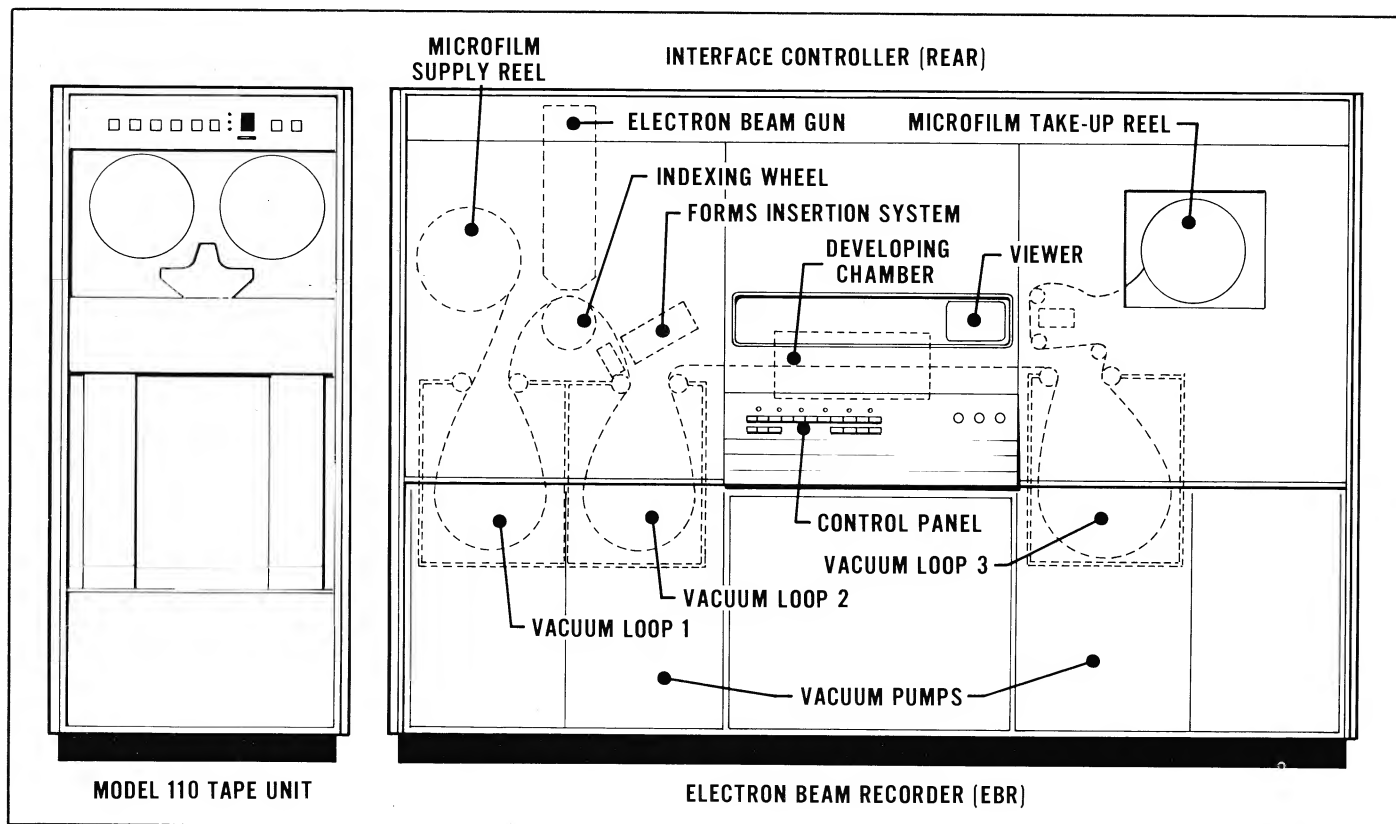


Figure 11. Mechanical Schematic Diagrams of Tape Unit and EBR

The following paragraphs describe the functional systems of the Series F Electron Beam Recorder and the Model 110 Tape Unit (Figure 11). The purpose of the Technical Description is to help the reader better understand the capabilities of the entire EBR system.

MODEL 110 TAPE UNIT

The 3M Model 110 Tape Unit is of a proven, conventional design. It handles 7 track (9 track compatibility with IBM Series 360 tape format is optional), one-half inch magnetic tape. Reel diameter is 10-1/2 inches. Storage densities are 556 or 800 characters per inch, transfer rates are 41,700 and 60,000 characters per second. Tape speed is 75 inches per second. The unit is complete with data electronics. The Model 110 operations are controlled from the EBR operator's control panel. Physical location should be adjacent to the EBR.

NOTE: The following paragraphs describe the functional systems of the EBR itself; the hardware for these systems is all contained within the EBR cabinet.

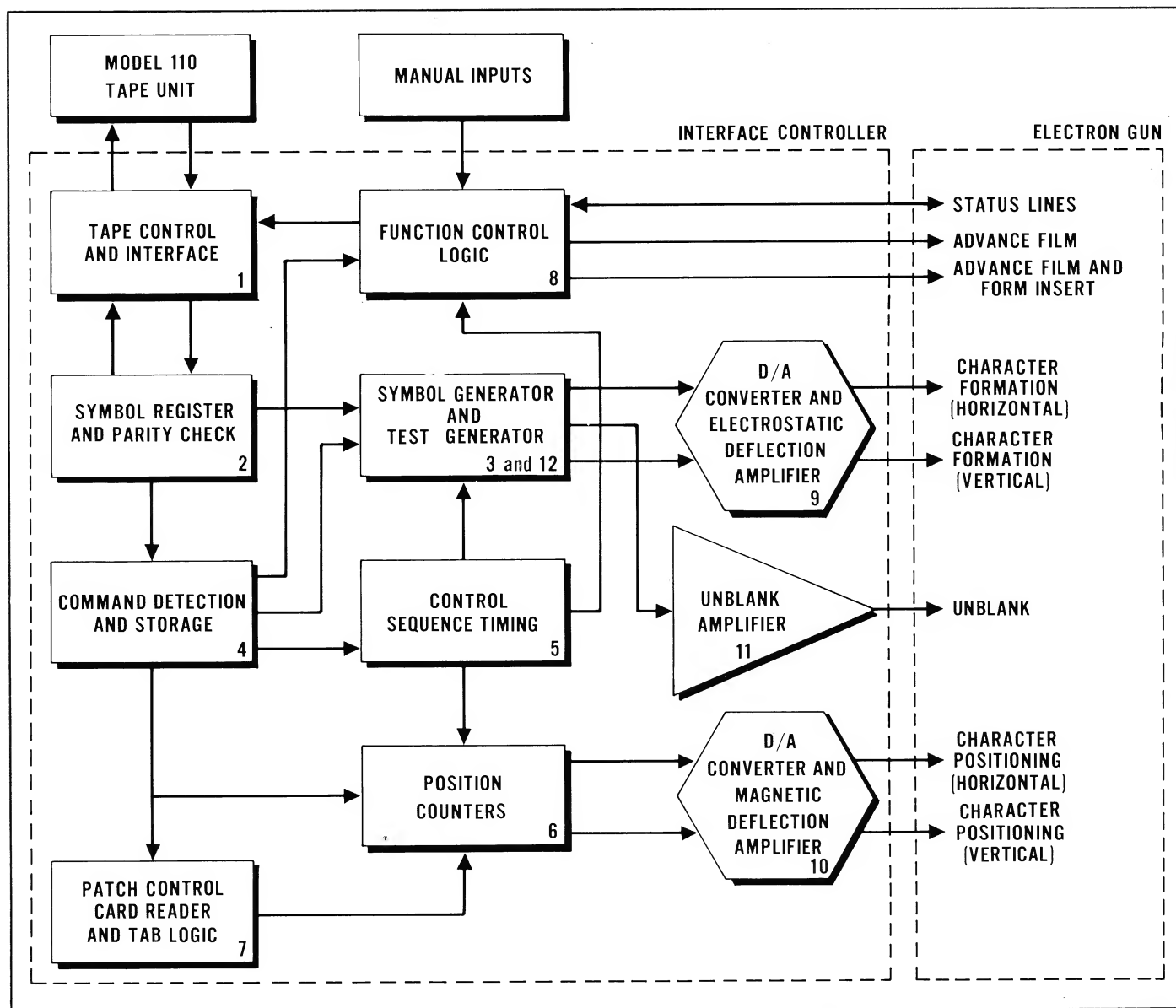


Figure 12. Block Diagram of Interface Controller.

INTERFACE CONTROLLER

The electronic Interface Controller is a complex of integrated circuits which converts digital input into analog signals suitable for modulating the electron beam, and thus forming and positioning characters on the microfilm. Inputs to the controller are: digital information from the tape (character and control codes), digital information from patch control card reader (tabulation, line skip, and compatibility mode codes), and signals from the operator's control panel. Figure 12 illustrates the Interface Controller in block diagram form. The following paragraphs briefly describe the function of each "block," or sub-system,

within the controller. Numbers within each block correspond to the numbers preceding each paragraph.

1. Tape Control and Interface - All signals necessary to perform a tape read operation are conditioned by this interface.
2. Symbol Register and Parity Check - Passive storage is required to examine the validity of each incoming tape character and to forward valid data to the Command Detection and Storage section or the Symbol Generator. In the event of an error, tape motion is stopped at the end of the data block and an indicator is illuminated alerting the operator to intervene as required to continue processing. The errored character will not be printed, instead the "?" will appear at the location of the error.
3. Symbol Generator -- Upon receiving a digital command, the Symbol Generator produces a digital pulse train, unique to the character represented by the digital input, which is sent to the Digital-to-Analog Converter and Amplifier (Block 9).
4. Command Detection and Storage - Command detection gates anticipate the various control codes and initiate the proper action in response to those codes. Frame advance action is an example of this function. Upon receipt of a frame advance code, the command is detected and stored in the Function Control Logic. At the proper time, the frame advance is executed, tape motion stops under control of the Function Logic (Block 8). Upon completion of the frame advance, tape motion starts and the Command Detection Storage is reset to anticipate the next frame advance.
5. Control Sequence Timing - As the name implies, this block controls the sequence of events programmed to occur. Symbol timing, positioning timing, and function timing are initiated as an output of a timing chain. This timing chain consists of a string of flip-flops that are set in a time sequence conditioned upon the first 3 or 4 characters following a record gap or a record mark.
6. Positioning Counters - The counters are appropriately advanced as a function of the symbol size selected, the last command detected, and the output of the patch control card reader. The output of the counters are digital positioning values that are sent to a Digital-to-Analog Converter and Magnetic Deflection Circuits (Block 10) to later position a symbol at a discrete lo-

cation on the microfilm image area. Using normal size symbols, 64 lines of 132 characters each may be recorded on a single frame.

7. Patch Control Card Reader and Tab Logic - The Card Reader's decimal output is converted into octal form for direct transfer to the position counters upon command.
8. Function Control Logic - This logic is primarily used to control input and output functions. It also provides for manual control such as message start, restart, and a number of other operator functions.
- 9, 10 and 11. Digital-to-Analog Converters and Amplifiers - The output of D/A Converters and Amplifiers drives the electrostatic deflection plates in the electron beam gun to form and position characters on the microfilm. The output of the unblank amplifier is sent to a control grid in the electron gun head. An unblank signal allows formation of the electron beam. An absence of the unblank signal (such as that time between character formations) allows the control grid to cut off the electron beam.
12. Test Generator - Activating the Test Generator selects a character (also selectable using other switches) and positions it at each and every character and line location within the image area. This test provides a check of the major logic elements, excluding the interfacing circuits. An indicator is illuminated when the Test Generator comes on and allows the operator to check input data from the tape unit.

FILM TRANSPORT SYSTEM

The Film Transport System consists of the film storage reel, film take-up reel, drive rollers, an indexing wheel, and three vacuum loops.

The 12-1/2 inch film reels can accommodate 2400 feet of 3.5 mil Dry-Silver Microfilm.

The indexing wheel positions the microfilm, in single frame increments, beneath the aperture of the electron gun. A near perfect seal exists at the film entrance and exit slots in the index wheel housing, allowing vacuum pumps to maintain the required vacuum within the electron gun.

While a segment of film is intermittently moving in one-frame increments past the electron gun, another segment is moving continuously through the developer chamber. The two vacuum loops of film adjacent to the index wheel serve as a buffer between these two film segments. They also provide a constant tension of the film. The third vacuum loop of film acts as a buffer between the constantly moving film segment in the developing chamber and the segment which is intermittently moving when the film inspection viewer is being used. Should the operator take too much time in viewing images, allowing the third film loop to become too large, the machine will automatically override the manual inspection mode and take up the slack film onto the take-up reel. In principle, the vacuum loops are similar to those common to tape units.

After the electron gun has written the last image called for by the program, the Film Transport System continues to advance the film until the last frame is developed. The frame can then be advanced to the take-up reel by pressing a control button.

ELECTRON BEAM GUN

The Electron Beam Gun (Figure 13) consists of an emitter assembly, casing, anode, magnetic lenses, deflection plates, and a yoke.

All components are contained within the casing which is maintained at an extremely low pressure by the action of vacuum pumps. Normally, a constant vacuum is maintained, being released only when maintenance is performed inside the gun.

The emitter assembly includes a cathode and control grid. Like any vacuum tube, the cathode is the constant source of electrons. The control grid is biased to cut off the electron beam except during the time when it is driven to a positive value by the unblank amplifier within the Control Interface (during the time a character is being written on the microfilm).

A high difference of potential exists between the anode and cathode. The anode accelerates the electrons to form an electron beam. Magnetic lenses are used for forming, or focusing, the electron beam. By changing system magnification, it is possible to enlarge beam width, therefore increasing the size of the characters (this is done in the Print Large mode of operation).

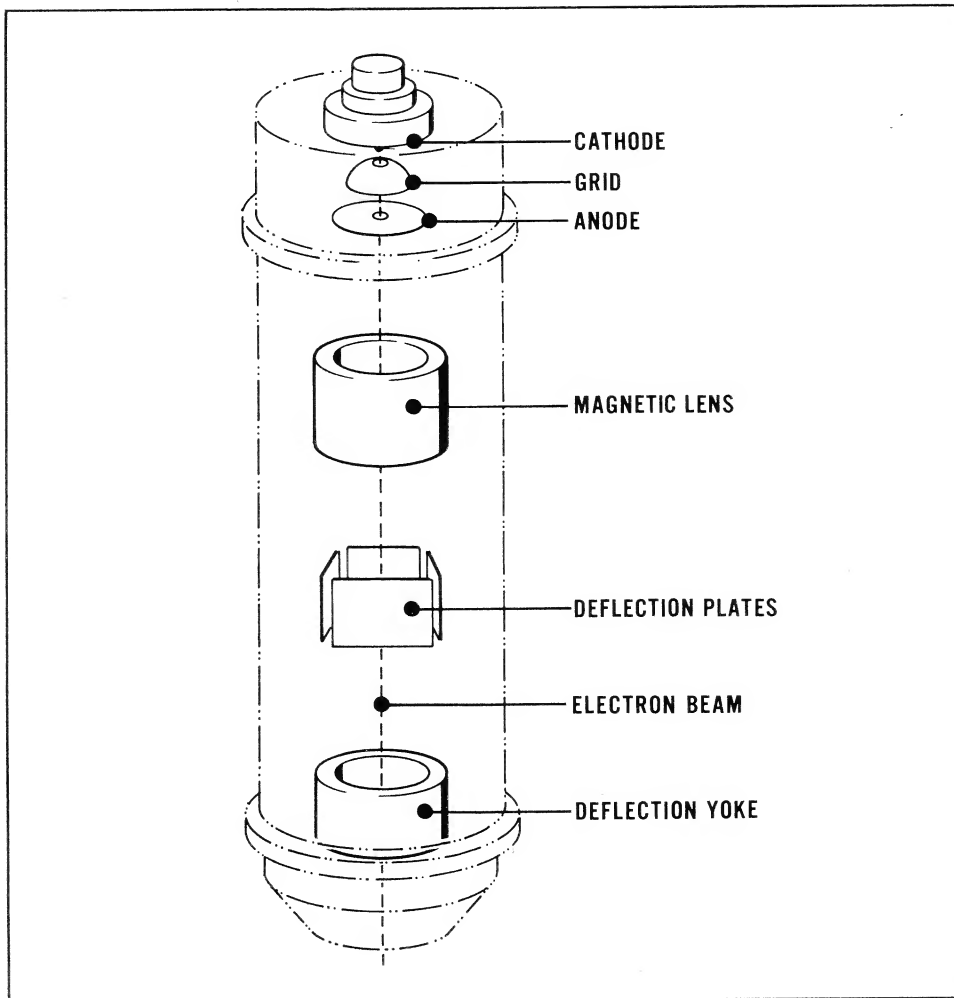


Figure 13. Mechanical Schematic Diagram of Electron Beam Gun.

Analog signals which represent characters are applied to the four deflection plates. The plates deflect the beam, much like the deflection plates in an oscilloscope, to "write" the character on the microfilm. Analog signals which represent character placement information (tab and line skip codes) are applied to the deflection yoke. The yoke, in turn, deflects the beam to the selected location of the microfilm.

FORMS INSERTION SYSTEM

The Forms Insertion System consists of a negative appearing microfilm frame, or a roll of frames having different formats, a strobe light, and the mechanical and electronic hardware necessary to facilitate forms insertion. The form is contact exposed (optically) to the Dry-Silver Microfilm in the presence of collimated light emitted by the strobe light. Forms insertion can be singular or randomly or sequentially programmed.

DEVELOPER SYSTEM

The Developing System is basically a chamber in which hot air is passed over the "exposed" Dry-Silver Microfilm, developing the latent image. Electronic-optical controls provide development which results in images having consistent quality.

FILM INSPECTION VIEWER

A Film Inspection Viewer allows the operator to inspect microfilm frames at random for proper forms insertion, image format and similar qualities. The viewer is of low power (10X), and therefore does not allow for inspection of individual characters.

OPERATION

This section of the manual does not give specific instructions on the operation of the EBR system, but rather gives the reader general operator requirements. In general, the operation of the EBR system is similar, in complexity, to that of conventional computer printout systems.

OPERATOR MAINTENANCE

Operator maintenance consists only of loading new reels of Dry-Silver Microfilm into the EBR.

OPERATION TECHNIQUES

Operation techniques are limited to inserting magnetic tape into the Model 110 Tape Unit, and actuating pushbuttons on the operator's control panel. Of course, the operator must have a complete understanding of the system with which he is working. The following is a list of switches (S) and indicator lights (I) located on the operator's control panel:

TAPE POWER (S and I)

CONTROLLER POWER (S and I)

SYSTEM READY (I)

FORMAT A/B (I)

PARITY ERROR H/V (I)
END OF FILE (I)
FILM SUPPLY OUT (I)
MODE NORMAL/TEST (S and I)
MESSAGE START (S)
BACKSPACE (S)
FILM ADVANCE (S)
FORM INSERT (S)
PARITY ODD/EVEN (S and I)
RUN/STEP (S)
AUTO ADVANCE (S and I)
CHARACTER SIZE SMALL/LARGE (S and I)
LINE WIDTH NORMAL/HEAVY (S and I)
CASE SELECT UPPER/LOWER (S and I)

SPECIFICATIONS

The following is a list of specifications for the 3M Series F Electron Beam Recorder:

INPUT: Digital information in BCD format. Storage densities can be 556 or 800 characters per inch; input speeds are 41,700 and 60,000 characters per second.

OUTPUT: Dry-Silver Microfilm, 16mm roll form. Image size is 14 by 14mm. Printout rate is up to 20,000 lines per minute. Film is positive appearing.

PHYSICAL SIZE: Height - 66 inches. Depth - 30 inches. Length - 99 inches. These dimensions exclude the magnetic tape transport.

POWER REQUIREMENTS: 208 volts, 20 amperes, 3-phase service.

ENVIRONMENT: Normal air conditioned, humidity controlled atmosphere suitable for computer systems.

FORMS INSERTION: Singular, random access or sequential.

LOCATION: EBR should be placed within two feet of tape unit. This is to reduce length of interconnecting cable.

DRY-SILVER FILM: 2400-foot reels, 3.5 mil thick. Up to 45,000 images per reel.



3M Microfilm Products Division
MINNESOTA MINING & MANUFACTURING CO.



GENERAL OFFICES • 2501 HUDSON ROAD • ST. PAUL, MINNESOTA 55119 • TEL. 733-1110

Microfilm Products Division

October 27, 1966

Mr. Theodor H. Nelson
Harcourt, Brace & World, Inc.
757 Third Avenue
New York 17, New York

Dear Mr. Nelson:

Enclosed is an information manual and a tentative price schedule for the 3M Series F Electron Beam Recorder system. The principle of direct electron beam recording offers recording speeds and resolution which are not subject to the limitations imposed by cathode ray tubes, cameras, and conventional wet film processing. Some of these advantages are as follows:

1. Printing speeds up to 60,000 characters per second on low-cost dry process film provide substantial time and cost advantages over conventional computer printing.
2. The recording film is instantly processed for immediate distribution.
3. The film images can be checked at the output station as soon as they have been recorded.
4. The inherent resolution of direct recording permits a variety of type styles including upper case, lower case, and bold face printing.
5. Background graphics can be superimposed or interspersed from either a random access or sequential source. This makes possible electronic forms control in such applications as catalog printing.
6. The IBM Print Image Mode permits recording of standard computer tapes with minimal reprogramming.
7. Use of integrated circuits and other advanced design techniques have provided substantial cost savings which are reflected in the selling price of the system.
8. A family of compatible microfilm readers and reader-printers provides viewing and hard copies of computer output.

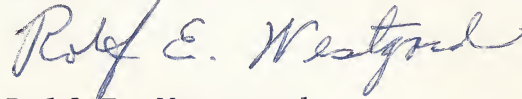
Mr. Theodor H. Nelson

- 2 -

October 27, 1966

We would appreciate your review and comments on the enclosed material.

Very truly yours,

A handwritten signature in dark ink, reading "Rolf E. Westgard". The signature is written in a cursive style with a large, stylized "R" and "W".

Rolf E. Westgard
Information Systems

REW/bz

Encls.

Tentative Price Schedule

3M Brand Electron Beam Recorder - Series F

<u>Description</u>	<u>Price, Purchase</u>	<u>*Rental Month</u>	<u>Maintenance Agreement, Year</u>
Model 100 Electron Beam Recorder, including TCU, Data Control Unit, Recorder and Off-Line Thermal Processor	\$80,000	\$ 3,000	\$ 5,400
Model 101 Electron Beam Recorder, including TCU, Data Control Unit Recorder with On-Line Thermal Processor	86,000	3,225	5,800
Visual Inspection Station	1,200	45	80
Single Forms Projector	6,000	225	400
Random Multiple Forms Projector (25 capacity)	9,600	360	650
Sequenced Multiple Forms Projector (2000 capacity)	9,600	360	650
Tape Transport, 7 Channel 556 and 800 bpi	10,400	375	670
Tape Transport, 9 Channel	11,100	415	745
Additional 64 character set, including lower case	15,000	560	1,000
Recording Film, 1000 feet	30		

* Includes Maintenance

3M Company
Information Systems
Microfilm Products Division

July 1966